THE

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A

POPULAR ILLUSTRATED MAGAZINE

OF

NATURAL HISTORY.

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VOLUME I.

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Page 10, line 23, for *interval*, read *instance*.
" 14, " 14, " *fig.* 1, *plate* 2, read *fig.* 5, *plate* 1.
" 19, " 18, " *spattered*, read *spatter*.
" 24, " 32, " *Beleware*, read *Delaware*.
" 42, dele lines 11, 12.
" 43, line 22, for *supersticious*, read *superstitious*.
" 44, " 1, " *nutricious*, read *nutritious*.
" 54, " 7, " *State. When the dates are found*, read *State, the dates will be found;* on line 8, for *latter, cease*, read *latter case*.
" 71, " 5, " *Wavey*, read *Wavy*.
" 78, " 3, " *supernumary*, read *supernumerary;* on line 15, for *their*, read *its*.*
" 167, " 13, " *active*, read *actinic*.
" 431, " 31, " FOSSIL, read FOSSORIAL.
" 491, " 9, " *leg*, read *hand;* dele line 25.
" 554, " 9, " *country*, read *county;* line 27, for *Scapiocrinus*, read *Scaphiocrinus;* line 40, for *Offil's*, read *Offel's*.
" 555, " 20, " *Palæozoic localities*, read *Palæozoic formations*.
" 570, " 15, " *Pl.* 15, *fig.* 14, read *Pl.* 14, *fig.* 3.

*All errata ending with this line, were corrected in the later editions.

THE

AMERICAN NATURALIST.

Vol. 1.—MARCH, 1867.—No. 1.

INTRODUCTORY.

In laying before our readers this first number of a popular scientific monthly, we commence a publication in which we shall endeavor to meet the wants of all lovers of nature.

The rapidly increasing interest in the study of the various departments of Natural History invites the establishment of a journal which shall popularize the best results of scientific study, and thus serve as a medium between the teacher and the student, or, more properly, between the older and the younger student of nature.

If the reader, however slight his intercourse with nature may have been, shall find something in these pages to stimulate his zeal, and direct his mind to the right methods of investigation, and also teach him new facts concerning the haunts and habits of his favorites of the wood, the lake and the seashore, the great aim of this

journal will be accomplished. Should it do no more than to bring naturalists, both young and old, into an active coöperation and sympathy, and promote good fellowship and amity between the great brotherhood of enthusiasts, as all true naturalists are, we shall gain a most important object. The value of our Magazine will depend more on its power to awaken the absorbing interest invariably excited by the contemplation of nature, and of illustrating the wisdom and goodness of the Creator, than on any adornment of style, or cunning devices of the artist.

We trust the Magazine will be equally welcome to the Farmer, Gardener and Artisan. We shall endeavor to point out the practical benefits resulting from the study of nature. The value of the study of the habits of insects, or Economic Entomology, the modes of breeding and development of animals and plants, and their distribution over the surface of the globe will be often discussed.

This is an utilitarian age, and all the theories now floating on the sea of science, all the stray facts not yet grouped in their proper places, besides the well digested facts which fill the treasury of knowledge, are all to be subordinated to the practical advantage as well as to the intellectual and moral elevation of man. As philosophers in seeking the truth for the truth's sake, let us not forget that our science will be ennobled by publishing those facts and principles which interest alike the philosopher and the day-laborer. The farmer and grazier are as much interested as the naturalist in all facts concerning the origin of

life and of specific forms, whether by direct creation, or by secondary laws as claimed by the followers of Lamarck or Darwin. In his work "On the Origin of Species," Darwin gathers many of his most important facts from the experience gained in the farmyard and garden, and all such facts are of practical value to the cattle breeder or horticulturalist. The studies of the astronomer in his observatory; the daily observation of the clouds and dew point; and of the barometer and thermometer, and the tracing of the course of storms interest alike the meteorologist, the farmer and the mariner.

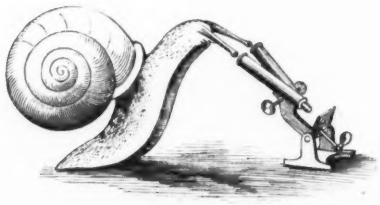
In our monthly calendar of the periodic returns of animals, farmers and gardeners will be warned of the attacks of insects injurious to crops. All inquiries respecting the attacks of such depredators will be answered in our columns, and modes of combating them be suggested.

As a medium between collectors, we trust the NATURALIST will be found of great use. Should the sportsman shoot a rare bird, or the insect-hunter capture a rare butterfly or beetle it may be here placed on record; or should the conchologist pick up a new shell which he is unable to identify from the means at his command, it will give us pleasure to aid in determining the name of his rarity; or, if unable ourselves, to place him in communication with specialists who have the requisite knowledge.

Such, then, shall be the leading object of the journal—to amuse the reader, perhaps decoy him within the temple of nature; and, if he be a willing student, instruct him in some of its mysteries.

The matter offered to our reader's acceptance will be mostly drawn from original sources. Occasionally we shall extract from the pages of our contemporaries. The most recent discoveries of general interest will be gleaned from the English, German, and French reviews and journals,—for science is cosmopolitan. Thus, following My Lord Bacon's bidding, we shall "prick in some flowers of that he hath learned abroad" for the better adornment of this our Naturalists' Companion and Solace.

The editorial responsibility seems great, and nothing but the boundless wealth of nature spread out before us, the untiring good will of our scientific friends in contributing to our pages, and the promise of the kindly appreciation of the public, can be an excuse for our appearance, and for any apparent presumption in our bearing.



THE LAND SNAILS OF NEW ENGLAND.

PLATE I.

BY E. S. MORSE.

We offer to our readers the first of a series of papers on the Land Snails of New England, with the intention of carefully figuring every species of land snail known to occur within the prescribed boundaries. We shall also give a general history of the group, mentioning the hiding places of different species, and whatever facts we may think of interest to the general reader.

Certainly a more unassuming subject could not well be studied, for aside from the soothing pleasure of lying down, dorsal region uppermost, in some secluded grove, and hunting for half a day among the decaying leaves, upturning the different layers of successive autumnal deposits of withered foliage, even as the geologist throws open the different pages of the "Great Stone Book," the earth's crust, in quest of material for study,—aside from this quieting pursuit, we have no stirring incidents in their life to contemplate, no frantic hops, skips, and jumps of the insect tribe, no terrible bites to dread, or poisonous stings to shrink from, no enemy of our husbandry (except occasional injury from the garden slug) to battle, no giant stride or rapid speed to wonder at; for the snail is proverbially slow in every respect. When disturbed, it does not, like many other animals, struggle violently to escape, but ceases motion, or quietly withdraws itself within its shell. Even the heart, which in higher animals, when agitated, pulsates with increasing energy, in the snail under similar excitement, throbs with a slower motion. And yet

we do believe that the careful study of a common snail will reveal the wonders of God's Providence in as forcible a manner as the history of the higher forms of animal life. Before presenting an account of the different species of land snails to be met with in New England, we must first learn something about the habits and anatomy of the group in general. Land Snails are universally distributed throughout the world, occurring under stones in open pastures, beneath the dead leaves and prostrate trees of the forest, in the interstices of bark, clinging to shrubs and spears of grass, lurking under damp moss, and occupying other positions of a similar nature. As they are dependant on the presence of a certain degree of moisture for their perpetuation and increase, they are more abundant in warm and damp regions, and are therefore found in greater numbers on islands, while in dry and desert places they are scarcely known to occur.

The land snails attain their greatest size and beauty in the tropics; the species diminishing in number and size as we approach the poles. Certain South American species attain the length of six inches, and the young when first hatched from the egg (which is as large as that of a pigeon), is an inch long.

We turn however with relief from the gaudy colored shells of the Equator, to our more humble representatives of the North, both modest and unpretending in size and color. The species native to the United States are essentially inhabitants of the forest, and there, dwelling under the damp leaves in continual darkness, do we seek the material for our study.

Figures 9, 10, and 11, plate 1, represent the common large snail of our woods, the white lipped snail or *Helix albolabris*. This snail is distributed throughout all

the Northern and Western States, and is a fair type of the family. The body is quite soft, and spreads below into an oblong, flattened disk. This disk is called the "foot," and forms their only locomotive organ. By means of numerous minute muscles distributed closely along this flattened surface, they are enabled to creep along, at times with an almost imperceptible motion, gliding smoothly over the roughest substances, ascending branches, and even burrowing in the ground. When we consider this sluggish, and too often despised snail, without legs, fins, or wings, and yet performing the important function of locomotion with as much certainty and ease as animals more highly endowed, we cannot but admire the versatility of the Great Creative mind in the various complete provisions made for the locomotion of all these humbler animals. During progression, the disk, or surface upon which they crawl, secretes a slimy, or viscid substance, which greatly facilitates their exertions, and they can often be traced to their hiding places, by following the silvery trail, which all snails leave behind, in their peregrinations. The English gardener, annoyed as he is by the depredations of certain species of snails, which nip the tender buds, and even devour the leaves of his plants, frustrates their destructive raids by encircling the plants with an earth work of dry sand; or better still, ashes. The snail, in attempting to pass this barrier, becomes completely entangled with the particles of sand adhering to its slimy body. Now, any irritation of this nature causes the snail to pour out this slime, or mucus, from all parts of the body, as can be easily proved by irritating the snail with the point of a stick, when shortly a ball of mucus will be formed on the stick, and the point finally rendered smooth. This provision to guard against such conditions, fairly ex-

hausts the snail in its attempts to pass the barrier, for the more abundant the secretion, the greater the entanglement, and finally the snail dies from exhaustion. Protections of this kind would be of no use in rainy weather, as the sand adheres together, and the snail can then pass over it very easily.

Certain species of slugs (Fig. 13, Plate 1), that is, snails having no coiled shell, but alike in other respects, have the singular power of lowering themselves from some projecting point by means of this mucus, which they throw off from the posterior end of the creeping disk; and we have seen a common slug (a species occurring abundantly in our garden and fields), lower itself from the back of a high chair to the floor. They have no power, however, like the spider, to retrace their course. They will often hang suspended in mid air for sometime, apparently for no other purpose than to enjoy themselves.

The snail has no power to leave its shell as many suppose. The shell is as much a part of the animal, as is the hard crust of a beetle a component part of the insect. And not only this, the snail is attached to the shell by a permanent muscular attachment, and cannot be withdrawn from it alive. In order to clean the shell of its contents, it is customary to scald it in boiling water, when the muscular attachment becomes separated from the shell, and the soft parts can be easily removed. The finding of empty shells in the woods, has oftentimes been cited as a proof that the snail can leave its shell, and the occurrence of certain species of snails which have no visible shell, has served to strengthen a belief in this error. When the creature dies, the soft perishable parts are soon decomposed, or else devoured by insects, leaving the more enduring shell as a monument to its memory. On the ap-

proach of winter, or the continuance of a severe drought, the snail hybernates, that is, it ceases to feed, and withdraws itself far within its shell, leaving at the same time several barriers within the aperture of the shell, composed of the mucous secretions of the animal. In this condition it remains, motionless and apparently lifeless. The mode of forming these partitions is quite curious, and will interest the observer. As the snail withdraws within the shell it inspires a certain quantity of air; the creeping disk, and the parts of the animal bordering the aperture of the shell pour out a certain quantity of mucus, which stretches completely across the aperture of the shell. This soon hardens, and the snail by expiring most of the air in its lungs, and thus reducing its bulk, retires still farther within its shell, and again forms a barrier similar to the one just formed, and oftentimes several partitions are formed in this way, one behind the other, affording a complete protection against the inroads of cold and water, and apparently of heat as well, since they always do this when confined in a dry or hot place. In a certain foreign species, this partition partakes of a calcareous nature, and thus affords a more enduring barrier. In the spring time the snail resumes its activity, the barriers are forced through by the tail, and frequently the snail devours them, as if famishing after its long continued fast.

All species of land snails with few exceptions, are oviparous; that is, the young are hatched from eggs laid by the parent. The sexes are united in each individual, though the mutual union of two individuals is necessary to fertilize the eggs. They lay from fifty to one hundred eggs at a time. The eggs of most species are very small, white in color, and resemble homœopathic pills. If the conditions are favorable, the young issue from the eggs in

the course of two or three weeks, furnished with a shell composed of one whorl and a half. The shell is increased in size by the addition of calcareous matter round the margin of the aperture. The successive lines of growth can be easily traced on the shells of most species. They attain their complete growth in from one, to two years. The number of eggs produced by an individual varies in proportion to the greater or less protection afforded to the animal; thus in the common slug, *Limax*, and allied genera, having no exterior shell into which they may withdraw in times of danger, the number of eggs produced is much greater, and according to Dr. Leach, who kept two specimens of the common garden slug in confinement, seven hundred and eighty six eggs were laid in one year.

The vitality which the snail's eggs possess surpasses belief. Certain French naturalists assert that they have been so completely dried, as to be friable between the fingers. In this dried condition they have been kept for a long time, and yet a single hour's exposure to humidity and warmth, has been sufficient to restore them to their original form and elasticity. They have been dried in a furnace eight successive times, until they were reduced to an almost invisible minuteness, yet in every interval have they regained their original bulk in a moist situation. In all these instances the young have been developed, in the same manner as other eggs not subjected to this experiment. (Binney.) This wonderful vitality extends to the snail in all stages of its existance. We have seen certain species frozen in solid blocks of ice, and yet regain their activity when subjected to the influences of warmth. Their dependence on moisture naturally places them in moist situations, yet we have seen certain species attached to leaves, where the sun had shed its scorching rays for

weeks, crisping the leaves, and baking the ground as dry as potter's ware, and yet these conditions not affecting in the least their vitality. They have been kept for years in pill boxes, and yet on subjecting them to moisture, have crawled about appearing as well as ever. In "Woodward's Manual of Shells" is the following, chronicled by Dr. Baird, regarding the resuscitation of a desert snail. "This individual was fixed to a tablet in the British Museum on the 25th of March, 1846, and on March 7th, 1850, it was observed that he must have come out of his shell in the interval (as the paper had been discolored, apparently in his attempts to get away) but finding escape impossible, had again retired, closing his aperture with the usual glistening film; this led to his immersion in tepid water and marvellous recovery." The power possessed by the snail to reproduce certain portions of its body removed by violence, has long attracted the attention of Zoölogists. The horns, or tentacles, and even portions of the head have been cut away, and in due course of time these lost parts have been restored by a new growth. The whole head has been cut away, and though in many cases terminating the life of the victim, yet in some instances the parts removed have been fully restored. This seems the more wonderful when we consider the complicated character of the head and mouth. The shell may be broken, and even portions of it removed, and yet after a certain lapse of time the injured parts will be repaired by a deposition of shelly matter at the fractured parts. We have thus far examined briefly the general history of the snail. Let us now proceed to examine more minutely its anatomical characters.

Figure 10, on plate 1, represents the common large snail of the woods, the white lipped Helix, or technically

speaking, *Helix albolabris*. It is represented as crawling, and consequently extended fully from the shell. The two larger and two smaller "horns" projecting from the head, are respectively called the upper or superior, and lower or inferior tentacles. The superior tentacles are the longest, and stand uppermost; at the tips of these are found the eyes, little black specks, though large enough to be distinctly visible. The eyes are very simple in structure, and probably serve no important use, as the snail in progression, appears to depend entirely on the tentacles as feelers to guide the way. While they crawl, the tentacles are continually in motion, and the tips oftentimes come in contact with various objects on the way. If the eyes were capable of ordinary vision, this occasional contact of the tentacles would be avoided.

That the sense of smell is enjoyed by the snail has long been known, since they will oftentimes travel some distance in quest of food for which they have a particular fondness; the exact seat of this sense, however, has long been a disputed question. An eminent French Naturalist believes it to be seated at the extreme tip of the larger tentacles. A magnified drawing is given (Fig. 1, Plate 1,) of the end of the larger tentacles to show the position of the nerves supposed to be the nerves of smell, or the olfactory nerves, (*o*, Fig. 1,) these are seen as minute threads or branches terminating at the extreme end of the bulb-like tentacle. In this figure the eye is also seen with the optic nerve. (*e.* eye, *op.* optic nerve.) The larger tentacles are retractible, that is, they have the power of withdrawing within the head, the eyes disappearing first, as a glove finger disappears as it is withdrawn over the hand, turning the glove wrong side out. The smaller, or inferior tentacles, have not this power of with-

drawing within the head, but remain always extended. When the snail is feeding, it is very curious to observe the listless appearance of the larger tentacles. A dog, or a cat, when feeding will often partially close the eyes and appear drowsy. It would seem that similar sensations are experienced by the snail, for while feeding, the tentacles are partially drawn within the head and hang downward, as if the delights of feeding were altogether too engrossing to mind the lax state of the tentacles. When on the trail, however, the tentacles are thrust out to their greatest length, perfectly rigid, and give an appearance of alertness to the snail that it does not possess. Just beneath the lower tentacles the mouth is situated, having on the upper lip a crescent shaped jaw, (Fig. 7, Plate 1,) of a heavy texture, and quite hard. In some species of snails, the jaw is quite smooth, and has a slight projection on the cutting edge. In other species, the larger ones especially, the jaw is ribbed, and the cutting edge is notched and jagged like so many teeth as it were. In fact this jaw answers all the purposes of an upper set of teeth, for it is capable of biting through the thick leaves of a cabbage; as can be easily proved, by keeping a snail in confinement, and feeding it on cabbage or lettuce, of which it is very fond. When feeding, all the movements of the mouth are plainly visible, and not only can the little semi-circular cuts of the jaw on the leaf be seen, but while feeding the nipping sound of the bite can be distinctly heard. The larger snails are also very fond of flour paste, and while luxuriating in this simple diet each white mouthful can be easily traced in its course, from the mouth to the stomach, owing to the translucency of the snail's body. The lower lip is not furnished with a plate, but just within the mouth there is

spread a membrane, very appropriately called the *tongue*, or lingual membrane, as the snail uses it in lapping its food. This membrane is quite long and broad, and is covered with minute silicious denticles, or teeth, as they are called.

As an object for the microscope, it will repay one the trouble attendant on dissecting this membrane from the mouth of a snail. A magnified figure of the entire tongue is given on plate 1, fig. 6. Nothing can exceed the beauty and regularity in the form and arrangement of the denticles. These are pointed and turn backwards, thus forming a series of little claws and hooks, and are admirably adapted to perform the rasping function allotted to them; fig. 1, plate 2, gives a side view of a few of these teeth to show their hooked character. The number of denticles on the tongue is very great. Some species, the white-lipped Helix, for instance, having nearly twelve thousand denticles. It is difficult to conceive the minuteness of these particles, when we consider that the membrane on which they rest is not a quarter of an inch long, and only half as wide. The denticles are arranged in regular longitudinal and transverse rows. Figure 3, plate 1, represents two transverse rows of these denticles, and fig. 4 a central tooth, with lateral teeth more highly magnified to show their form. It will be noticed that the central denticles are symmetrical in form, having the two sides alike, while those on each side are not symmetrical. In illustrating the dentition of a species, it is only necessary to draw one half of one transverse row, including the central denticle, at the same time mentioning the number of transverse rows on the membrane; thus in the white-lipped Helix, a specimen of which we examined, we found eighty-nine denticles in a transverse row, that is, one

central denticle, flanked on each side by forty-four lateral denticles. There were one hundred and twenty-three transverse rows, making the whole number of denticles on the membrane ten thousand nine hundred and forty-seven, or, about eleven thousand. The form, and number of denticles in each species vary, as we shall show hereafter.

In looking for the breathing hole of the snail, those ignorant of its structure might refer to the mouth as the opening through which it inhaled air. It is a common idea that insects breathe through the mouth, because the higher animals do so. Now insects breathe through little perforations on the sides of their body, and the snail has an aperture on the right side of its body, just within the aperture of the shell, through which it breathes. This aperture can be plainly seen in the mantle or skin which fills the mouth of the shell, (Fig. 11, a, Plate 1) by turning the snail over. The lung is a simple cavity, lined with a net work of blood vessels. The blood is a bluish colored fluid, and is circulated through the body and lung, by a pulsating heart composed of two chambers, an auricle and a ventricle, separated by a double valve. The heart's pulsations can be distinctly seen through the lower part of the translucent shell of many species. Fig. 2, *h*, plate 1, represents the heart situated in the pulmonary cavity. In this figure the lung is represented as turned back from the animal, exposing the heart. Fig. 12 represents the heart and lung of a common slug. It would lead us too deep into the anatomy of the snail, were we to indicate the character and position of the liver, kidney, and many other organs which combine to make up the complicated structure of our apparently simple snail. Suffice it to say, that however insignificant many of the lower

animals appear to the common observer, yet a description of their minute anatomy alone would form many a chapter of surpassing interest to those who delight in contemplating the perfection of God's works.

In our next paper we shall commence the description of the different species of land snails to be found in New England.

EXPLANATION OF PLATE 1.

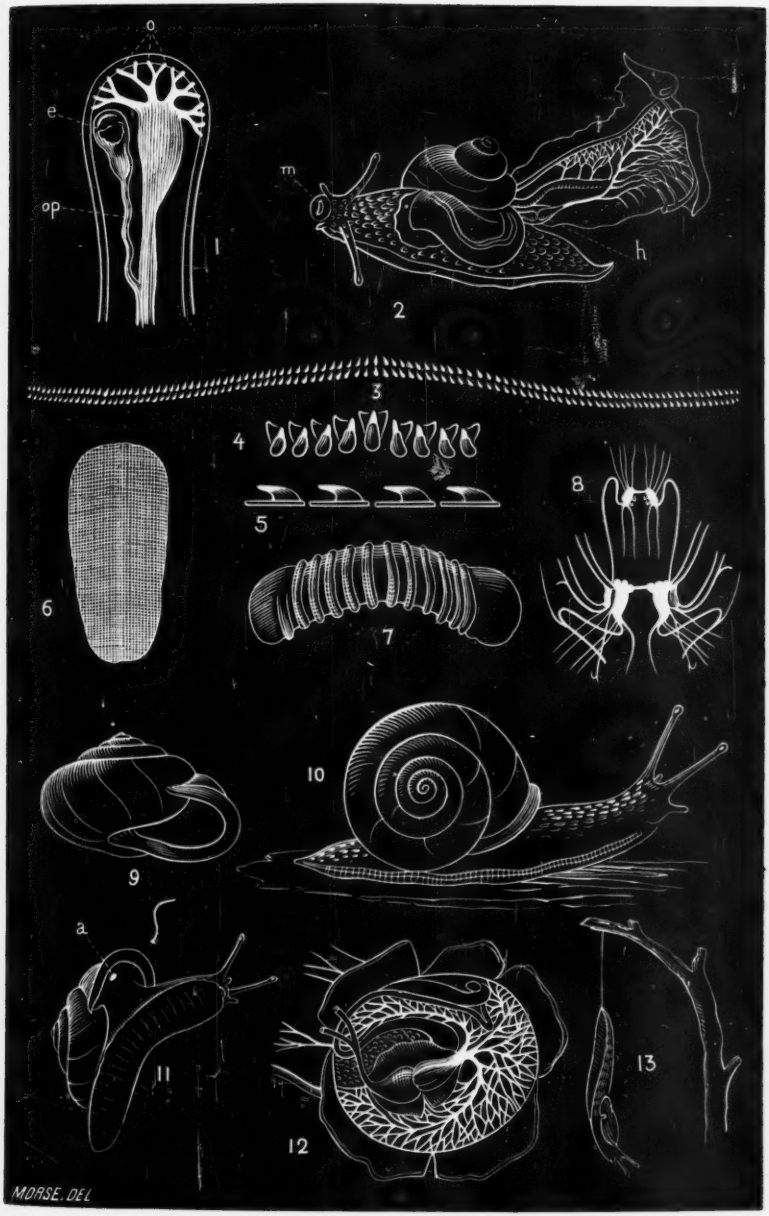
Fig. 1. Magnified view of superior tentacle of a snail. *op.* optic nerve; *e.* eye; *o.* olfactory nerves.
Fig. 2. *Helix albolabris*, with shell removed and mantle thrown back, showing lung and heart. *m.* mouth; *h.* heart.
Fig. 3. One row of teeth from the same, magnified.
Fig. 4. A portion of one row of teeth from the same, highly magnified.
Fig. 5. Side view of teeth of the same.
Fig. 6. Entire tongue of same, enlarged.
Fig. 7. Jaw of same, magnified.
Fig. 8. Nerve centres of *Helix albolabris*.
Fig. 9. Shell of *Helix albolabris*.
Fig. 10. *Helix albolabris* crawling.
Fig. 11. " " turned back, showing orifice to lung, *a*.
Fig. 12. Lung and heart of Garden Slug, *Limax flavus*.
Fig. 13. Slug suspended from twig.

THE VOLCANO OF KILAUEA, HAWAIIAN ISLANDS, IN 1864-65.

PLATE 2.

BY W. T. BRIGHAM.

Soon after one o'clock we came upon the brink of the great crater. From below us steam and vapor rose in a sluggish column, but we saw no fire and heard no noise: the conflagration had, as it were, left nothing but smoking ruins to mark the scene of its triumph. The deep plain before us was surrounded with steep rock-walls, from



MORSE ON THE LAND SNAILS OF NEW ENGLAND.

three to seven hundred feet high, and nearly nine miles in circuit. Boston could easily be accommodated within this crater, and Vesuvius would not much more than fill it. The whole circuit of the walls is much broken and interrupted, and we rode along over several large cracks, one of which opened about a year since (in 1863). Some are concentric, and others radial, and all along the edges of the abyss are fumaroles from which issue clouds of steam, not as at the Geysers of California, with great noise, but gently as a quiet respectable teakettle pours out its vaporous offering. The steam had no smell of sulphur, and ferns were growing luxuriantly over the openings, while the condensing vapor formed pools of sweet water, the only source of drinking water in this fire-searched region.

When we reached the north-western part of the crater, we found on our left a ridge of reddish earth, from which steam and strong sulphurous fumes poured in many places. This was the western Sulphur Bank, and in its cracks were forming the most beautifully delicate crystals of sulphur, almost mosslike; and here and there a blue crystal of sulphate of copper, and greenish masses of sulphate of iron. The earth, which is formed by the decomposition of the lava, was quite hot, and we found some natives cooking fern stalks in the steam.

While we were examining the sulphur deposits, our men came up with our blankets, and we at once engaged an old kanaka who lived near by, to guide us down into the crater. Two other kanakas went with us to carry water and bring back specimens. The descent was at first quite steep, down the hard grey walls; and then the path wound along on broken shelves, under a grand precipice two or three hundred feet high, quite perpendicular, and

looking as if built of regular blocks of stone. Small shrubs grew by the way, and we picked berries (vaccinium) in abundance. At last after a rapid descent on a steep gravelly bank, we stepped into the fresh black lava of the crater floor. This floor looked quite smooth and level from above, but we found it was very rough and uneven. The fresh lava we first met had broken up during the last winter and overflowed all the end of Kilauea, and it was piled in twisted masses and broken slabs and bubbles. Its surface was covered with a thin nitrous crust, which crumbled beneath our tread, sounding as hard-frozen snow does on a frosty morning, and thus a distinct path had been worn to Lua Pélé or the great fire-pit which is at the south-western end of the crater proper.

Half a mile of such travelling and we came to a wall of hard trachyte, quite unlike the lava of the floor, which seems to have been floated up here from the walls below. The great blocks which compose it are said to change their position from time to time as the floor rises and cracks. Fissures of all sizes were common, and from many of them steam issued changing the black lava to a reddish hue. The action of vapors and gases had produced fragments of all shades and colors, some so metallic as to closely resemble gold, others red, violet, green, etc. Now and then we broke through the thin crust of a bubble, and although we could not repress a momentary shudder as we thought of what might be the result of a fall into the regions beneath, the stirring interest of the place drove away considerations of personal danger.

After two miles we came to a fearful crack about three or four feet wide, and so deep we could not see the bottom, but still there was no sound that we did not make ourselves, and we could not see any fire. I was certainly

disappointed in this, for I remembered the accounts of those who had seen all this plain in a melted state. As we came near the Lua Pélé, however, we found a black cone some twenty-five feet high, with a bright spot at its summit. There was fire at last, but we pushed on over the loose slabs, and through the steam, until suddenly we stood on the brink of the lake of lava some seven hundred feet long, five or six hundred feet wide, and perhaps thirty feet below us. The surface was covered with a dark crust, broken around the edges where the thick blood-like mass surged against its banks with a dull sullen roar. The sulphurous vapors which rose from its surface were blown away by the wind, so that we could approach the very brink on the windward side, but the heat was so great that we had to hold our hands before our faces. The walls on which we stood and where we intended to sleep, were thickly covered with Pélé's hair* which we saw constantly forming. The drops of lava spattered out as the waves dash against the walls, drawing after them a thread, or two drops spin out a thread between them like the finest "spun glass," and these broken threads are caught against the rough points of the cliffs and form a thick coating.

Occasionally a crack would open in the surface of the lake, and the white-hot lava boil up through it in several places for a few minutes, and then turning red, and cooling rapidly, become black as before. A current would often set in towards the banks, and cake after cake breaking off from the crust be drawn in, causing a violent bubbling and spattering; and then this would cease, or run in another direction, but always from the centre to the edge.

As it grew dark we were very tired, having travelled

*Pélé was the Hawaiian Goddess of fire whose home was in Kilauea.

since six o'clock in the morning, and hoping to wake up in the night when the fires would be more brilliant, we rolled ourselves up in our blankets, and, with our guides near by, went to sleep a few rods from the crater. At nine o'clock I waked, and as the night air was quite cold, moved to the very edge of the crater to warm myself, and enjoy the magnificent fireworks. The moon was up and almost full, but her light was dull beside the fires of Pélé. Finding the place quite comfortable, I picked out a soft rock for a pillow, and went to sleep again. At twelve I awaked with a start and found myself in a shower of fiery drops, some of which were burning my blanket. I shook myself and jumped back, looking at my watch to note the time, and then stood gazing at the strange scene some time before I thought of my companions. The whole surface of the lake had risen several feet, and was violently boiling and dashing against the banks, throwing the white-hot spray some sixty feet over the upper banks, causing the providential rain that awakened me to see this grand display. There was no thundering or bellowing, only the splash of the waves as they fell back, or the rattling of the cooled drops on the upper banks. The light was so intense as to be almost painful, as the crust had wholly melted, and brilliant fountains of fire covered the surface.

When I could think of anything else, I called the others, but only succeeded in awakening the guides, and just then a drop of lava came plump into a greasy newspaper we brought our supper in, and it blazed up suddenly, to the dismay of our guides, who, thinking that the volcano had broken out at our feet, at once fled to a safe distance. Failing to arouse them with my voice, I threw several handfuls of gravel at the sleepers but without effect, and I had to climb down, almost blinded by gazing at the fire,

BRIGHAM ON THE CRATER OF KILAUEA IN 1864-5.

and shake them roughly. When they at last reached the edge the action had greatly diminished, and in a few minutes more the dark crust covered the central portion, extending rapidly to the sides, and after watching the last crack close, we all went to sleep again. I was glad to see such distinct flames, as their existence has been denied in volcanoes. They were bluish-green, and shot up in tongues or wide sheets a foot long.

In the morning we found it very misty, and the mist soon turned to rain. We went to the cone we had seen the night before, and climbing its spattered sides, looked into the hole in the top. We could see that it was white-hot within, but we were unable to excite it, although we threw in pieces of scoria, and poked it with our sticks. On the other side of the path was a cone, long and irregular, with many pinnacles from which much smoke issued. We got quite wet in climbing up the bank, and at seven o'clock were eating our breakfast in the grass house on the upper ledge.

A year afterwards I again went to Kilauea. Many changes had taken place. Lua Pélé was much larger, and two new pools had opened during the winter. The place where I slept last August had melted away, and I was obliged to camp in another place. The superstitions of the natives have always been greatly excited while in this crater, and I saw many reasons for it. As we walked towards the bright lake about dusk, I thought I saw two or three men walking to and fro on the brink, and asked my guide what strangers had been down into the crater. "Aole haole aka akua paha"! (It is no stranger but perhaps a spirit) said the old man, so solemnly that I was startled. As the steam moved in the wind, it opened and brought to view the black cliffs beyond, and this we had taken for

moving men, not reflecting that the forms must have been gigantic at such a distance from us. In ancient times the bodies of the chiefs who worshipped Pélé were committed to this pit.

As we were sitting on the brink, a shrill shriek broke through the night air. We could see the black walls of the crater all around us, and between us and the pathway leading out, a line of watchfires, and I was quite as much impressed as my natives with the direful stories they had been telling me. The shriek was repeated, and it was evidently the utterance of a human being in great agony. Lighting the lantern we had brought for any emergency, we went slowly towards the place, until the shriek was uttered at our very feet. We hastily examined the cracks and called, but there was no answer, and all was still. We looked everywhere, finding no one, and turned to go back, thinking some poor kanaka, venturing down in the dark, had fallen into some crack, and at last died.

We had gone but a few rods when the shriek was repeated. The natives clung to me in mortal terror, but I insisted on going back, and placing the lantern on a rock, we sat down to await developments; it seemed as though the question, "are there any spirits present?" was quite superfluous. We sat more than five minutes in silence, and I could feel the poor fellows tremble as they sat close up to me. Then the shriek was repeated, but we saw the spirit that made it,—a jet of steam—and my boys were encouraged.

The smaller lakes were close to the surface, and I could put my stick into the melted mass. It was strange to see how soon the lava cooled on the surface. As soon as it had ceased bubbling, I threw a small perfectly dry stick of wood into it, and it was more than fifteen minutes before it smoked much.

This last visit was in August, 1865, and ever since that time the action in the crater has been increasing, until the floor of this vast pit has risen nearly a hundred feet, and at times has been quite inaccessible, owing to the streams of lava flowing over the surface.

THE FOSSIL REPTILES OF NEW JERSEY.

BY PROF. E. D. COPE.

In traversing New Jersey from north west to south east, we pass over rocks and soils which have been deposited by an ocean whose coast has constantly moved toward the south east, until its position has become that now forming the boundaries of the State. Hence the material now nearest the coast is that last laid down, and as we proceed towards the north west, the beds are a sediment of successively older and older date. Not, however, till we reach the red sandstone of the line of New Brunswick, do we meet with formations which have suffered a sufficient amount of pressure and heating to convert them into stone to any great extent. The gradual recession of the ocean has been occasioned by a similarly regular elevation of the land in its rear. This elevation was however, only gradual during portions of the time; between such elevations existed long periods of rest. For instance the red sandstone mentioned before was for a very long time within the shore of the ancient ocean. During that time beds were deposited outside of an older coast land, which subsiding later, were covered by newer beds, which include the remains of those creatures that have died near the

shore and been washed into the sea, or have died in the ocean. With a continued sinking, including now the red sandstone, the newer deposits reached in time the level of its summits; and during the subsequent and long continued rise, a succession of sea beaches gradually extended the area of the land to the south east. Abundant vegetation clothed the shores, which supported insect life and large herbivorous animals, which were in turn fed upon by smaller and larger carnivorous forms. The period during which the deeply buried strata at the side of the red sandstone was deposited, is called by geologists that of the Lower Cretaceous; while that which forms the surface resting upon the last, and extending from the red sandstone over nearly half the remainder of the state of New Jersey, is the Upper Cretaceous formation. During the deposition of the former, extensive beds were being laid down in various parts of the earth, especially western Europe, which entombed similar animal and vegetable types. With the Later Cretaceous of New Jersey also, corresponding strata were deposited in the far west of North America, and Europe, including in England the well known white chalk rock. At the close of this epoch, New Jersey, most probably, had accomplished in its south eastern section a very extended and considerable elevation, and at the same time vast changes in other regions of the earth caused a great change in the temperature; so great as to destroy all animal life then existing. It is also certain that the south eastern extremity of the region underwent a second gradual descent, and was again covered with water to a coast line running north east and south west, dividing the present land between the south western bend of the Deleware and the present coast line into two nearly equal areas. Then began again the deposi-

tion of beds, and the introduction of entirely new forms of animal life more like those of modern times. The period during which this deposit, so near the present coast line, was formed, as also many corresponding deposits in other regions of the earth, is called in geology, the Tertiary. Its beginning was the "morning of the sixth day" of the Mosaic record of the Creation. This great period, after having seen many changes, culminated in the creation of man. At this point history begins, and no extended geologic changes have taken place since. We have advanced six thousand years, or probably, considerably farther into the "seventh day" or period.

The beds of green marl were laid down during the upper Cretaceous period. At a suitable depth of water along the several ancient coasts, lived immense numbers of minute marine creatures, called *Foraminifera*, which inhabited delicate, almost microscopic shells, composed of numerous cells. After their death the chamber of the cells became filled with the fine mud formed of dissolved clay, oxide of iron and other substances, which are enumerated by Prof. G. H. Cook, in his valuable Report on the Geology of New Jersey. When the beds were raised, the drying, and other agencies brought to bear, decomposed the delicate shells, and left only the hardened mud as casts of their chambers. Hence the green marl now resembles gunpowder, deriving its peculiar color from the protoxide of iron.

The valuable properties of this marl, as a manure, no doubt depend on the products of the decomposition of the vegetables and animals formerly dwelling in the ocean or on the neighboring shores. The numerous fossiliferous beds, one or more of which are usually cut across by the diggings, have supplied in part this material. Most of

the animals found in these beds were bivalves, with numerous Brachiopoda and Cephalopoda, or Cuttle-fish. Of the unsymmetrical univalves, or Gasteropoda, comparatively few specimens occur in the Cretaceous marl of New Jersey.

Of Vertebrata, or those animals provided with a back bone, or vertebral column, numerous species, large and small, dwelt on the land and in the water. Their number has been so considerable, especially in the region opened by the diggings of the New Jersey Marl Company, as to materially affect the richness of the marl in phosphate of lime. Of cartilaginous vertebrates, such as the Sharks, we have found remains of the genera *Otodus*, *Lamna* and *Carcharodon*. Some of these were not only very numerous but attained a great size, and were of ferocious habits. There were also Saw-fishes closely allied to those of the present day. Fewer remains of the bony fishes, such as the Perch and Cod, have been procured from these pits; while in other neighborhoods Sword-fish and long fanged *Sphyræna* types have occurred.

In huge reptiles the region has been especially prolific. Through the care of Superintendent Voorhees, the remains of seven of the larger species have been exposed and preserved during the excavations. Four of these belonged to the group of Crocodiles; namely:—

Thoracosaurus Neocæsariensis DeKay; carnivorous.
Thoracosaurus obscurus Leidy; "
Bottosaurus Harlani Meyer; "
Macrosaurus lævis Owen; ?
Hyposaurus Rodgersi Owen; ?

These were probably dwellers by the shore, and devourers of the large fishes and of any luckless reptiles strolling on the beach. A gigantic precursor of the still

existing Lacertilia (Lizards) was probably whale-like in habit; and though not equalling these monsters in size was still formidable, attaining a length of thirty feet. It was probably in part also carnivorous. This huge reptile was called *Mosasaurus Mitchellii* by DeKay, and its remains are more numerous than any other, except those of the large Thoracosaurus.

Another group of animals, the *Dinosauria*, while approaching in some respects the mammals and birds, presented more of the features of the reptiles. Many of them were the giants of the land of the Cretaceous time, as well as of its waters. Those whose remains have been found in the Company's pits, are *Lœlaps aquilunguis* Cope, which was carnivorous, and *Hadrosaurus Foulkii* Leidy, an herbivorous animal.

The last was the most bulky quadruped of the period yet known; a femur, or thigh bone, discovered near Haddonfield, measures nearly four feet in length. The animal is estimated by Professor Leidy to have been twenty-five feet long. The *Lœlaps* has been found represented in the Company's pits, only by remains sufficient to ensure its identification, a few small pieces from the neighborhood of Freehold, described by Professor Leidy, being assignable to an allied, or doubtfully to the same genus. As the former constitute the most complete indication of any individual of a carnivorous Dinosaurian hitherto discovered considerable interest attaches to them. The great reptile, *Megalosaurus*, is known by more numerous fragments, but they have been gathered from many different localities; *Dinodon* is known only from its teeth, and *Euscelosaurus*, of the South African beds, by a femur only.

The lightness and hollowness of the bones of the *Lœlaps*

arrest the attention of one accustomed to the spongy, solid structure in the reptiles. This is especially true of the long bones of the hind limbs; those of the fore limbs have a considerably less medullary cavity. The length of the femur and tibia render it altogether probable that it was plantigrade, walking on the entire sole of the foot like the bear. They must also have been very much flexed under ordinary circumstances, since the indications derivable from two humeri, or arm bones, are, that the fore limbs were not more than one-third the length of the posterior pair. This relation, conjoined with the massive tail, points to a semi-erect position like that of the Kangaroos, while the lightness and strength of the great femur and tibia are altogether appropriate to great powers of leaping. The feet must have been elongate, whatever the form of the tarsi; the phalanges, or finger bones, were slender, nearly as much so as those of an eagle, while the great claws in which they terminated were relatively larger and more compressed than in the great birds of prey. There was no provision for the retractibility observed in the great carnivorous mammalia, but they were always equipped with sheaths and crooked points of bone. The toes may have been partially webbed, and it is not improbable that the hind legs may have occasionally been most efficient propellers of these animals along the coast margins of the Cretaceous sea.

The hind foot could not have been straightened in line with the tibia, owing to a most anomalous structure which has only been once before observed, and then in a species clearly referred to its type. The distal head of the fibula, or small bone of the leg, appears to have embraced and capped the tibia like an epiphysis, and to have given attachment to the bones of the tarsus, by a condyle directed

anteriorly. The object of this structure remains unexplained. The whole hind leg could not have been less than six feet, eight inches in length.

Fragments of the jaws indicate a face of very considerable length, showing shining saw-edged, knife-shaped teeth; but any nearer idea of the beast's expression cannot now be attained. If he were warm-blooded, as Prof. Owen supposes the Dinosauria to have been, he undoubtedly had more expression than his modern reptilian prototypes possess. He no doubt had the usual activity and vivacity which distinguishes the warm-blooded from the cold-blooded vertebrates.

We can, then, with some basis of probability imagine our monster carrying his eighteen feet of length on a leap, at least thirty feet through the air, with hind feet ready to strike his prey with fatal grasp, and his enormous weight to press it to the earth. Crocodiles and Gavials must have found their bony plates and ivory no safe defence, while the Hadrosaurus himself, if not too thick skinned, as in the Rhinoceros and its allies, furnished him with food, till some Dinosaurian jackalls dragged the refuse off to their swampy dens.

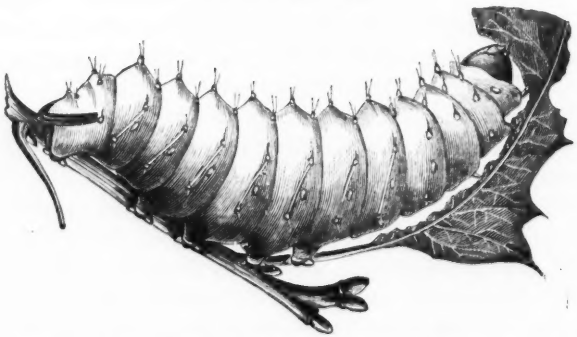
This carnivore, then, is an interesting link between those of the mammalian series, and the carnivorous birds. In the first, all four limbs are equally developed, and similarly employed as weapons of offence; in the last, the functions of the anterior pair are altogether different from those of the hind limbs, which are alone armed for the capture of food. In the Dinosaur, the hind limbs appear to have served the same purpose as in the Raptorial bird, while the fore limbs are simply miniatures of the same, and chiefly of service in carrying food to the mouth.

It will readily occur to the palæontologist, that the ex-

istence of creatures of the form of Lælaps, Iguanodon, and Hadrosaurus, would amply account for the well known foot-tracks of the Triassic Red Sandstone of the Connecticut Valley. The arguments adduced to prove that these were made by birds are equally applicable to their indicating the presence of Dinosaurians; and as the latter have been found very much more nearly approximated in time —as *Scelidosaurus* in the Jurassic formation—the latter hypothesis is altogether the more probable of the two in the estimation of the writer.

THE AMERICAN SILK WORM.

BY L. TROUVELOT.



The insect fauna of North America contains several gigantic species of moths belonging to the Lepidopterous family Bombycidæ. This family has long been known to spin when in the larval, or caterpillar state, a cocoon which produces a large amount of silk, with a fibre of the most delicate texture, of great strength and of the most

beautiful lustre. Every one is familiar with the beautiful and delicate fabric made from the fibres spun by that crawling repulsive creature, the silk worm.

Our country alone has eight or ten species of silk worms. Two of these, Callosamia Promethea and C. angulifera, feed on the lilac and wild cherry. They spin a small elongate cocoon of so very dense texture and so strongly gummed, that I have failed in all my attempts to reel the silk from the cocoon. These cocoons resemble very much those of Samia Cynthia, or the Ailanthus Silk Worm, recently introduced into Europe from China, but the cocoon is of a looser texture. Platysamia Euryale, P. Columbia and P. Cecropia feed upon many different species of plants; they make a large cocoon, within which is another cocoon, or inner layer, of an oval form; but as the larva in spinning the cocoon, leaves one end open for the exit of the moth, this prevents the reeling of a continuous thread. The silk, though quite strong, has not much brilliancy, and the worm is too delicate to be raised in large numbers.

The caterpillar of Tropæa Luna, the magnificent green moth with the long tail-like expansion of the hind wings, feeds upon the oak, sycamore and other trees, and spins an oval cocoon, which however is so frail and thin, and the fibre so weak, that it is impossible to reel it.

Practically, however, the larva of Telea Polyphemus is the only species that deserves attention. The cocoons of Platysamia Cecropia may be rendered of some commercial value, as the silk can be carded, but the chief objection as stated above, is the difficulty of raising the larva. The Polyphemus worm spins a strong, dense, oval cocoon, which is closed at each end, while the silk has a very strong and glossy fibre.

For over six years I have been engaged in raising the Polyphemus worm, and here present the following imperfect sketch of the progress made from year to year in propagating and domesticating these insects from the wild stock.

In 1860, after having tested the qualities of the cocoons of the different species of American silk worms, I endeavored to accumulate a large number of the cocoons of the Polyphemus moth, for the future propagation of this species. At first the undertaking seemed very simple; but who will ever know the difficulties, the hardships and discouragements which I encountered. This worm having never been cultivated, of course its habits were entirely unknown, though all success in my undertaking depended very much upon that knowledge. However I was not discouraged by the difficulties of the task. The first year I found only two caterpillars. The chance of their being each a male and female was very small, and it was another question whether the two sexes would come out of the cocoon at about the same time for the fecundation of the eggs. So success was very doubtful. Spring came, and with it one of the perfect insects; it was a male, one, two, three days elapsed, my poor male was half dead, the wings half broken, the other cocoon was not giving any signs of an early appearance; imagine my anxiety; it was a year lost. The male died on the sixth day. The other moth came out more than a fortnight after; it was a male also. During the summer of 1861, I found a dozen worms, knowing then a little about their habits. In the spring of 1862, I was fortunate enough to have a pair of these insects that came out of the cocoon at the proper time, and I obtained from their union three hundred fecundated eggs. The pair which gave me these eggs

were the originators of the large number which I have cultivated since. Of these three hundred worms, I lost a great many, not knowing their wants, but I succeeded in obtaining twenty cocoons in the autumn. It was only in 1865 that I became expert in cultivating them, and in that year not less than a million could be seen feeding in the open air upon bushes covered with a net; five acres of woodland were swarming with caterpillar life.

Natural History of Telea Polyphemus. Early in summer, the chrysalis of Polyphemus which has been for eight or nine months imprisoned in its cocoon, begins to awaken from its long torpor, and signs of life are manifested by the rapid motion of its abdomen. In the latitude of Boston, the earliest date at which I have seen a perfect insect is the twentieth of May. From this time until the middle of July, the moths continue to come out of the cocoons. The cocoon being perfectly closed, and a hard gummy, resinous substance uniting its silken fibres firmly together, it is quite hard for the insect to open it, as it has no teeth, nor instrument of any kind to cut through it, and the hooked feet are far too feeble to tear such a dense structure.

But the moth must have some means of exit from the cocoon. In fact they are provided with two glands opening into the mouth, which secrete during the last few days of the pupa state, a fluid which is a dissolvent for the gum so firmly uniting the fibres of the cocoon. This liquid is composed in great part of bombycic acid. When the insect has accomplished the work of transformation which is going on under the pupa skin, it manifests a great activity, and soon the chrysalis-covering bursts open longitudinally upon the thorax; the head and legs are soon disengaged, and the acid fluid flows from its mouth, wetting

the inside of the cocoon. The process of exclusion from the cocoon lasts for as much as half an hour. The insect seems to be instinctively aware that some time is required to dissolve the gum, as it does not make any attempt to open the fibres, and seems to wait with patience this event. When the liquid has fully penetrated the cocoon, the pupa contracts its body, and pressing the hinder end, which is furnished with little hooks, against the inside of the cocoon, forcibly extends its body; at the same time the head pushes hard upon the fibres and a little swelling is observed on the outside. These contractions and extensions of the body are repeated many times, and more fluid is added to soften the gum, until under these efforts the cocoon swells, and finally the fibres separate, and out comes the head of the moth. In an instant the legs are thrust out, and then the whole body appears; not a fibre has been broken, they have only been separated.

To observe these phenomena, I had cut open with a razor, a small portion of a cocoon in which was a living chrysalis nearly ready to transform. The opening made was covered with a piece of mica, of the same shape as the aperture, and fixed to the cocoon with mastic so as to make it solid and air-tight; through the transparent mica, I could see the movements of the chrysalis perfectly well.

When the insect is out of the cocoon, it immediately seeks for a suitable place to attach its claws, so that the wings may hang down, and by their own weight aid the action of the fluids in developing and unfolding the very short and small pad-like wings. Every part of the insect on leaving the cocoon, is perfect and with the form and size of maturity, except the pad-like wings and swollen and elongated abdomen, which still gives the insect a

worm-like appearance; the abdomen contains the fluids which flow to the wings.

When the still immature moth has found a suitable place, it remains quiet for a few minutes, and then the wings are seen to grow very rapidly by the afflux of the fluids from the abdomen. In about twenty minutes the wings attain their full size, but they are still like a piece of wet cloth, without consistency and firmness, and as yet entirely unfit for flight, but after one or two hours they become sufficiently stiff, assuming the beautiful form characteristic of the species. If, while the wings are growing, they are prevented from spreading by some agency, they will be deformed forever. Sometimes when the wings are developing, the afflux of liquid is so great, that some parts of the wing swell up considerably, and if one of these swellings be opened with a pin and the sac emptied a singular phenomenon will result; the wing which has lost so much of its fluids will be smaller than the others, and sometimes it will retain the normal form of the wing, only being smaller, while the wound can be detected only on very close observation. I have in my cabinet a perfect specimen of such an insect; naturalists would regard it as a monstrosity.

The moth remains quiet all day, and sometimes all night and the following day, if the night be cold; but if it be warm and pleasant, at dusk or about eight o'clock, a trembling of the wings is observed for a few minutes and then it takes its flight, making three or four circles in the air. The male flies only a few minutes, and then rests for two or three hours in the same place, not making any motion. It is worthy of notice that the place of rest is always the extremity of an oak leaf. Why he remains there so long I could not ascertain. The female continues to fly

about the bushes, and though a virgin, she lays eggs which are, however, of no use for the propagation of the species; she continues so doing for two or three hours, and then rests all night attached to some plant, probably waiting for her mate, who during this time has either remained motionless, or has been feeding on the sweet exudation of the oak leaf. Soon after the female moth has laid these useless eggs, the males become very active, and fly in search of their partners, whom they soon discover, especially if there be a slight breeze and the air loaded with vapors.

The moth lays her eggs on the under side of the leaves, sometimes on a twig; generally but a single egg is deposited at one place, rarely are two or three found together. I have observed that eggs are sometimes laid upon plants which the young larvæ refuse to eat, and in several instances where there was no other plant within a long distance, and consequently the young worms died; thus it seems that instinct, like reason, sometimes commits blunders, and is not so infallible a guide as has been supposed.

The incubation of the eggs lasts ten or twelve days, according to the temperature. The young worm eats its way through the shell of the egg; sometimes the young larva comes out of the egg tail foremost, as the hole in the shell is large enough to allow of the exit of the tail, but is not large enough for the head to pass through, so the worm is condemned to die in the egg. As soon as it is fairly hatched out, the larva continues for sometime eating the egg-shell, and then crawls upon a leaf, going to the end of it, where it rests for two or three hours, after which it begins to eat. The hatching-out takes place early in the morning, from five till ten o'clock; rarely after this time.

The Polyphemus worm, like all other silk worms, changes its skin five times during its larval life. The moulting takes place at regular periods, which come around about every ten days for the first four moultings, while about twenty days elapse between the fourth and fifth moulting. The worm ceases to eat for a day before moulting, and spins some silk on the vein of the under surface of a leaf; it then secures the hooks of its hind legs in the texture it has thus spun, and there remains motionless; soon after, through the transparency of the skin of the neck, can be seen a second head larger than the first, belonging to the larva within. The moulting generally takes place after four o'clock in the afternoon; a little before this time the worm holds its body erect, grasping the leaf with the two pairs of hind legs only; the skin is wrinkled and detached from the body by a fluid which circulates between it and the worm; two longitudinal white bands are seen on each side, produced by a portion of the lining of the spiracles, which at this moment have been partly detached; meanwhile the contractions of the worm are very energetic, and by it the skin is pulled off and pushed towards the posterior part; the skin thus becomes so extended that it soon tears, first under the neck, and then from the head. When this is accomplished the most difficult operation is over, and now the process of moulting goes on very rapidly. By repeated contractions the skin is folded towards the tail, like a glove when taken off, and the lining of the spiracles comes out in long white filaments. When about one-half of the body appears, the shell still remains like a cap, enclosing the jaws, then the worm as if reminded of this loose skull-cap, removes it by rubbing it on a leaf; this done, the worm finally crawls out of its skin, which is attached to the fastening made for the purpose. Once

out of its old skin, the worm makes a careful review of the operation, with its head feeling the aperture of every spiracle, as well as the tail, probably for the purpose of removing any broken fragment of skin which might have remained in these delicate organs. Not only is the outer skin cast off, but also the lining of the air tubes and intestines, together with all the chewing organs and other appendages of the head. After the moulting, the size of the larva is considerably increased, the head is large compared with the body, but eight or ten days later it will look small, as the body will have increased very much in size. This is a certain indication that the worm is about to moult. Every ten days the same operation is repeated; from the fourth moulting to the time of beginning the cocoon, the period is about sixteen days.

The worms seem entirely unable to discern objects with their simple eyes, but they can distinguish light from darkness, as a very simple experiment will show. If a worm be put in a box with two holes in it, one of them turned to the light, the other to the dark, the caterpillar will very soon come out through the hole turned to the light.—*To be continued.*

WINTER NOTES OF AN ORNITHOLOGIST.

BY J. A. ALLEN.

The winter birds of the northern and eastern States are few in number. In Massachusetts, away from the sea shore, there are ordinarily but fifty-five to sixty species, which consist mainly of permanent residents and winter visitors from more northern districts. The resident

kinds are either rapacious birds, or such hardy species as Titmice, Jays, Woodpeckers, Nuthatches, Finches and Grouse, whose means of subsistence is about equally sure at all seasons. A few are, more properly, migrant summer species, of which only hardy adventurous individuals linger with us in winter, the majority seeking a milder home farther south: among such are the Meadow Lark, Kingfisher, Cedar Bird and Robin. The winter visitors are all from the north; many of these are irregular in their visits, coming to us only when driven southward by the severity of the weather, or more probably by scarcity of food. Of this whole number the limits of our paper will allow us to notice but a few, and even of the more interesting to give but very brief accounts.

The rapacious or raptorial birds, the Hawks and Owls, though comparatively numerous in species, are not so in individuals. Shy and mistrustful, seeking the retirement of the wilderness or the forest, and the nocturnal kinds active only by night, they form but an inconspicuous feature in our local ornithology. Constantly persecuted by man, they have decreased greatly in numbers since the first settlement of our country, and every year they seem more and more to avoid the cultivated districts, seeking a more congenial home in the less inhabited parts of the continent.

Of the true or typical Falcons, esteemed the "noble" birds of prey in the old days of falconry, we have in winter, as at other seasons, now and then a Duck Hawk or Peregrine Falcon (*Falco anatum* Bon.), a Pigeon Hawk (*Hypotriorchis columbarius* Gray), and a Sparrow Hawk (*Tinnunculus sparverius* Vieill.), but so rare are they that a careful observer will ordinarily see but one or two of each in a winter, or perhaps oftener none at all. The

first of these, the dreaded Duck Hawk, is frequent along the sea border and large open rivers where abound the aquatic birds that form his chief prey. The celebrated White Hawk or Jer-Falcon (*Falco candicans* Gm.) is larger and more powerful even than the Peregrine, but it comes to us so rarely from its remote arctic home, as to be justly considered but an accidental wanderer.

Of the hawks, properly so called: namely, the short winged and "ignoble" birds of prey, the majority are migratory in the more northern sections of the Union, going south in winter. One, however, the Gos-Hawk (*Astur atricapillus* Bon.) is a winter visitor, and subsisting upon rabbits, partridges, jays, and such other birds and poultry as fall in his way, is a bird of considerable celebrity for his strength and boldness. Formerly his European ally of the same name, and with which the earlier ornithologists supposed ours to be identical, was held in great esteem in hawking, and according to Pennant, was considered of unequalled value among the short winged hawks for the purposes of falconry. It is, moreover, when mature, of beautiful plumage, the white under surface being elegantly pencilled transversely with waved ashy-brown lines, and with broader longitudinal stripes of a dark ferruginous hue. The young are more plainly colored, and differ for several years so widely from their parents, as to be hardly recognizable as belonging to the same species. I once found a wing of this bird, which had been dropped in the woods by some bird of prey; the flesh had been torn from it, leaving only the bones of the upper and fore arm, and the primary quills, showing that even such tyrants of the air are not exempt from enemies more powerful even than they. Possibly it was the Duck Hawk that in this case was the destroyer, since its representa-

tive in Europe, the Peregrine, is known to have a particular relish for the flesh of other hawks, and to hunt the poor Kestril as its most dainty game.

The well known "Red-tail," (*Buteo borealis* Gm.) from his retreat in the forest, sometimes makes sudden forays on the poultry. Several kinds of large and sluggish hawks silently await in the open meadows the appearance of their minute but favorite game, the field mice, and the Marsh Harrier (*Circus Hudsonius* Vieill.) anon skims rapidly over the snowy fields in eager quest of food. But the most beautiful, when in mature plumage, as well as the largest of our winter birds of prey, is the historical White-headed, or Bald Eagle (*Haliætus leucocephalus* Savig.), most inappropriately chosen for our national emblem. The Golden Eagle (*Aquila Canadensis* Cass.), a far nobler bird, is perhaps almost too uncertain a visitor to warrant enumeration in our list.

The Strigidæ, or Owls, the "mysterious birds of night" are even less common than the preceding group, though in winter the number of species is increased by migrants from the north. The resident kinds of most frequent occurrence are the Mottled Owl, (*Scops asio* Bon.) perhaps better known as the "Screech Owl", the Great Horned or Cat Owl (*Bubo Virginianus* Bon.), the Barred Owl (*Syrnium nebulosum* Gray), the Short-eared Owl (*Brachyotus Cassinii* Brew.), and the Long-eared Owl (*Otus Wilsonianus* Less.) Of the migratory species the most common and best known is the Snowy Owl (*Nyctea nivea* Gray) which visiting us, at times, in considerable numbers, at once attracts attention from its large size and white plumage. Very rarely the Great Grey or Cinereous Owl (*Syrnium cinereum* Aud.), one of the largest and most handsome of the American Owls, pays us a visit

from his home in the Canadas and sub-arctic regions. In northern New England the semi-diurnal Hawk Owl (*Syrnia ulula* Bon.) is comparatively common, and lurking near the hunter profits by the pieces of game which he throws away, or now and then captures wounded birds.

Excepting the cruel, selfish and solitary raptorial species, our winter birds mostly associate in groups, not of individuals of a single kind merely, but of species, drawn together chiefly perhaps from similarity of food, and probably also from real love of each other's society. The winter representatives of these birds are of larger size, and of brighter colors than those seen in summer.

In the savage Butcher Bird or Northern Shrike (*Collyrio borealis* Baird), which seems but a hawk in miniature, we have, nevertheless, an exception to the gregarious tendency generally observed in winter among our smaller birds. He is one of our regular, but not very numerous visitors during the colder parts of the year, though less common than in the fall and spring; when those that winter farther south pass us in their migrations. It is, however, bolder, recklessly pouncing on birds in cages exposed near open windows. The song of a Canary will often retain him in the vicinity for a long time, waiting, restless and impatient from hunger, for an opportunity to make it his victim. In the woods he is continually quarrelling with the Jays, which both fear and hate him, and I have seen him in hot pursuit of a Chickadee, which was trembling with fright.

In winter all our birds seem to possess an unusual interest, perhaps no less from their scarcity than from the cheeriness their presence seems to lend. None, however, are dearer to me than the little woodland group of Titmice, the Nuthatches, the Creepers, the diminutive King-

lets, and the spotted Woodpeckers we so frequently meet in our forest walks.

Although the smallest of all our birds, except the Humming Bird, the Gold-crested Kinglet (*Regulus satrapa* Licht.) is one of the most hardy of our winter visitors, and is the more interesting from his exceeding diminutiveness. With a body hardly larger than a hickory nut, it is so thickly clothed with downy plumage that on a cold morning, when every delicate feather is fully expanded he looks like a ball of animated down, and thus clad, he is able to defy old Boreas.

Our winter field birds, like the field birds of summer, are chiefly members of the numerous Sparrow and Finch family, or Fringillidæ. Among them the beautiful Snow Bunting (*Plectrophanes nivalis* Meyer) is one of the largest, and when whirling from field to field in compact flocks, their white wings glistening in the sunlight, form one of the most attractive sights of winter; and most commonly appearing about the time of heavy falls of snow, and disappearing during continued fine weather, there is in the popular mind a degree of mystery attached to their history, being the "Bad weather Birds" of the superstitious. Cold half-arctic countries being their chosen home, they only favor us with their presence during those short intervals when their food in the northern fields is too deeply buried; and being strong of wing and exceedingly rapid in flight, they can in a few hours leave the plain for the mountain, or migrate hundreds of miles to the northward. The most common and frequently seen however, is the Yellow Bird (*Chrysomitris tristis* Bon.), but so changed in appearance in his plain winter suit of drab, that he is scarcely recognised as the beautiful Goldfinch we so much admired in summer. Feeding on the

abundant supply of nutricious seeds furnished by the weeds that rise above the snow, as well as on the seeds of the hemlock, the spruce, the larch, the alder and birch of the swamps and thickets, he never lacks for food, even in the severest weather; roving in flocks, social and joyful, he seems the very ideal of contentment. One of his more common associates is the Pine Finch, or Northern Siskin, (*C. pinus* Bon.); though rather more partial to the forests than he, they greatly resemble each other in their notes and general habits; but the latter, from its more pointed wings and slender form, is swiftest in flight, and possesses milder and more wiry notes, often heard while its author is far beyond our sight.

Some of the members of this large family, such as the two species of Crossbills, depend so much for food on the coniferous forests as to be seldom seen far away from their borders. The Common or Red Crossbill (*Curvirostra Americana* Wilson), though partially resident, is of desultory habits, and is never commonly seen, except when the pine woods, their usual home, are well laden with cones. The White-winged (*C. leucoptera* Wilson), its smaller but more beautiful congener, and an inhabitant of the northern forests of the Old World as well as of America, we only see at irregular intervals, commonly years apart. The winter of 1859-60 is memorable with bird collectors for their great abundance in our spruce and larch swamps, as well as for the occurrence of a very unusual number of other northern strangers. The Crossbills, by the great strength of their maxillary muscles, and their strong oppositely curved mandibles, are able to pry open the tightly appressed scales of the fir cones, and to extract at pleasure the oily seeds, which other birds equally fond of have to wait for the elements

to release. The Pine Grosbeak, or the Bulfinch of the North (*Pinicola Canadensis* Cab.), is another species more or less dependent on the forests, the Virginia Juniper affording him favorite food. His home, too, is the mountains and uninhabited northern timber lands. They visit us but occasionally, and then in such small parties, locally distributed, as to escape general observation.

Among our more familiar resident birds, there are but few species that seem as numerous in winter as at other seasons; of these the Blue Jay (*Cyanura cristata* Swains.) is a prominent example. Though unusually social in his disposition, he is yet hardly gregarious. The noisy screams of small scattered parties reach us from the swamps and thickets almost daily, and in the severer weather individuals make frequent excursions to the orchard and farmers' cribs of corn, the few grains they pilfer being amply paid for in the destruction of thousands of the eggs of the noxious tent-caterpillar. The poor Crow (*Corvus Americanus* Aud.), despised or persecuted by nearly all, is a bird of unusual interest to every lover of nature, and is a true friend to the farmer, though he finds in the latter a most inveterate enemy. The few Crows that remain with us during the long cold winter, seem able to support but a miserable existence; but no sooner does returning spring and the bare earth afford them a supply of grubs and other noxious insect larvæ, than they fare liberally, and their labors thus contribute vastly to the welfare of the farmer. Capable of withstanding the deforesting of the country, which has exterminated so many of our larger birds, he needs but little encouragement to become one of our most familiar and useful birds.

Passing by numerous species of our winter birds, including the rasorial kinds, or the Grouse and their allies,

and others of equal interest with those already mentioned, we have but space to notice very briefly some of our winter water-fowl. Those found at this season inland or remote from the sea, are so exceedingly few as scarcely to attract attention. They are confined exclusively to the tribes of Ducks and Grebes. The Whistle-wing or Golden-eyed Duck (*Bucephala Americana* Baird), the Goosander or Sheldrake (*Mergus Americanus* Cass.) and the Hooded Merganser (*Lophodytes cucullatus* Reich.), are occasionally seen on the rivers about open water, being much more common at the beginning of the season or towards spring, than in mid-winter. Along our coast, however, are found numerous representatives, many of which are visitors from more northern regions, and nearly all of which are of rare or of unknown occurrence very far inland. These by their numbers serve most agreeably to enliven our bleak coast. Such are the Gannets and Shearwaters, Jager Gulls and Terns, with the Eider Duck, Puffin, Auks and Guillemots.

The number of common species of winter birds is less than *one-tenth* the number of the common species in other seasons; while the difference in the total number of individuals is even much greater, a scarcity of birds being eminently, in our latitude, one of the characteristics of the season of winter.

In reviewing carefully a complete list of our Winter Birds, we are forcibly struck with the small proportion of species that can be considered as regularly common. Thus, out of nearly sixty species of inland birds that are known to inhabit southern New England in winter, we find but fourteen that we can hope to meet with at all frequently; the remaining seventy-six per cent. falling into the class of rare, though regularly occurring, migrants

and residents, or into the list of irregular and occasional visitors. The proportion of rare species to common ones, of irregular visitors to the regular, is perhaps well exhibited by the subjoined tabular *résumé:*

Species	common	14
"	rare	45
"	resident	26
"	migrant	33
"	irregular in their visits (and occuring in winter only)	7
"	of summer that linger occasionally in winter	4
Total of Winter Birds		59

The following table further shows what families are represented, and the number of species of each, as well as the number resident and migrant, rare and common.

		Common.	Rare.	Resident.	Migrant.
1.	Falconidæ (*Hawks*)	0	9	5	4
2.	Strigidæ (*Owls*)	0	9	6	3
3.	Picidæ (*Woodpeckers*)	2	1	2	1
4.	Alcedinidæ (*Kingfishers*)	0	1	0	1
5.	Turdidæ (*Thrushes, etc.,*)	0	2	0	2
6.	Bombycilidæ (*Waxwings*)	0	2	1	1
7.	Laniadæ (*Shrikes*)	0	1	0	1
8.	Liotrichidæ (*Wrens, etc.*)	0	1	0	1
9.	Certhiadæ (*Creepers*)	1	0	1	0
10.	Sittidæ (*Nuthatches*)	1	1	1	1
11.	Paridæ (*Titmice*)	1	0	1	0
12.	Fringillidæ (*Finches, etc.*)	2	8	1	9
13.	Icteridæ (*Troupials*)	0	1	0	1
14.	Corvidæ (*Crows and Jays*)	2	0	2	0
15.	Tetraonidæ (*Grouse*)	1	0	1	0
16.	Perdicidæ (*Quails*)	1	0	1	0
17.	Anatidæ (*Ducks*)	2	5	3	4
18.	Colymbidæ (*Divers*)	1	4	1	4
		14	45	26	33

The whole number of families represented, as may be seen from the above exhibit, is eighteen; only five (Falconidæ, Strigidæ, Fringillidæ, Anatidæ, Colymbidæ) have each more than three species, and excepting those of one family (Fringillidæ), are all to be reckoned among the rarer kinds. The Fringillidæ, or Finch family, has the greatest number, and probably in individuals outnumbers all the others together; it has, however, but a single resi-

dent species (the Yellow Bird), and only two (the Yellow Bird and Tree Sparrow), that can be counted as regularly common in winter. The two families of raptorial birds have each five or six resident species, but of the total of nine species furnished by each, all, as already observed, are rather rare species.

REVIEWS.

ON THE LYSIANASSA MAGELLANICA, AND ON THE CRUSTACEA OF THE SUBORDER AMPHIPODA AND SUBFAMILY LYSIANASSINA FOUND ON THE COAST OF SWEDEN AND NORWAY. *By Prof. William Lilljeborg.* pp. 38, with 5 plates. *Upsala*, 1865. 4to.

In this well illustrated paper, which is written in our own language, we are introduced to a very remarkable exception to the usual law of the distribution of animals. A species, one of the most gigantic of its group, being three inches in length, which was first discovered near Cape Horn, by D'Orbigny, reappears, upon the authority of Prof. Fries, near Spitzbergen, "on the bank by Beering Island." The specimens from the two localities were not actually compared, but a drawing and description of the *Lysianassa Magellanica*, from Spitzbergen, were found to agree perfectly with Milne Edwards' type-specimen collected by D'Orbigny. Sceptics may require the specimens to be placed side by side, before accepting the conclusions of even such eminent authorities as those named above. Other species of animals are said to be common to both poles. Three species of shells, "Saxicava arctica, Venus púllastra, and Pecten pusio," and a Crustacean, are said by the author to be "found both on our northern coasts, and at the Cape of Good Hope, though not in the intermediate tropical regions." The author enumerates several *genera* of interpolar shells, and also quotes as follows from Prof. Fries regarding the plants of these regions:

Hooker enumerates *Eriyeron alpinus, Carex festiva, Phleum alpinum and Trisetum subspicatum*, but it is probable that on closer examination these will be found to be nearly related, but different species. A remarkable example of a species common to both the Arctic and Antartic regions, and not met with elsewhere, is afforded by the beautiful and easily distinguished species of moss, *Unea melaxantha*, which is met with in Greenland and Spitzbergen, as well as in New Zealand and the most southerly portions in America. The only difference between the northern and southern forms is, that the latter seems

more thriving and fructifies richly, whereas the former is a more delicate plant, and has never yet been met with in a fructificating state. It is also curious that a so remarkably distinct form as the *Nephroma arcticum*, which is so generally met with in the northern alpine and subalpine regions, should nowhere else be represented by any analogous or similar form, excepting at Magellan Straits, where the very similar and nearly related *Nephroma antarcticum* is met with. Among the phanerogamous [flowering] plants, the genus Empetrum presents the same phenomenon, being in the north, principally represented by the *Empetrum nigrum*, whereas in Antartic America the *Empetrum rubrum* is the prevailing species, unless (as I have lately seen asserted) this latter be also found in Northern America.

No species of vertebrate animal is known with certainty to be common to both poles.

Contributions to the Knowledge of Crustacea, found Living in Species of the Genus Ascidia. *By T. Thorell.* From the Transactions of the Royal Academy of Science of *Stockholm.* Bd. iii., pp. 84, 14 plates. 4to.

In this valuable paper we have a very full account of some curious little crustaceans, allies of our common water-fleas found swimming in our fresh water pools. These strange forms are parasitic in the outer thick envelope (test) of the ascidians, or "shelless clams"; much as *Pinnotheres ostreum*, the little oyster crab, lives as a guest in the shell of the oyster. Observers should be on the look out for them in the ascidians of this country.

On the Polypes and Echinoderms of New England, with descriptions of new species. *By A. E. Verrill.* From the Proceedings of the Boston Society of Natural History, April 18, 1866. pp. 25. 8vo.

Professor Verrill here gives us a very useful list of all the sea Anemonies, Star-fish and Beche-le-mers, or Sea-cucumbers, as they are often called, which are found on our north eastern coast. To those who may be dredging, or engaged in the less exciting search for these interesting forms in the tidal pools, and under the sea weeds along the shore, this pamphlet will be invaluable.

The Myriapoda of North America. *By Prof. Horatio C. Wood, jr.* From the Transactions of the American Philosophical Society. *Philadelphia*, 1865. pp. 92, illustrated with 3 plates and over 60 cuts. 4to.

To young collectors and entomologists generally, the Thousand-legs and Centipedes one occasionally meets with in his rambles, are stumbling blocks. In this monograph, containing so complete an account of their structure and forms, the author has filled a great gap in American Natural History. The plates are in the main very well drawn; but there has been an oversight in representing all the legs pointing towards the tail, which is not the natural position. Those on the anterior half of the body should have been directed towards the head.

NATURAL HISTORY OF ANIMALS.' *By Prof. Sanborn Tenney and Mrs. Abby A. Tenney.* New York, 1866. Scribner & Co. 12mo.

This little work, as the title indicates, presents in a general way the Natural History of Animals. The illustrations are mainly the same as those contained in a previous work by Prof. Tenney on Natural History. The figures are mostly drawn from American sources, and the book will be found quite useful to those who wish to obtain a knowledge of our native animals. As the work is intended for beginners, the style is plain and free from technicalities. Yet we regret the absence of the technical names, for we believe that on all occasions, the scientific name of an animal should be coupled with its common one, so that gradually the popular mind may become accustomed to the use of that which is so essential to a proper understanding of the study, and more particularly, a clear appreciation of the value of classification.

ON THE YOUNG STAGES OF A FEW ANNELIDS. *By Alexander Agassiz.* From the Annals of the Lyceum of Natural History, New York. Vol. viii., p. 303. June, 1866, 6 plates, pp. 40. 8vo.

In this interesting article we find accounts of the early lives of some of our common marine worms. Though necessarily fragmentary, from the difficulty of obtaining these creatures in all their stages of growth, yet such facts as we here learn about the early stages of the Nareda-like worm, are of the highest interest to the philosophic naturalist.

This worm is a long, narrow, smooth-bodied Nemertean, with two eye-specks on the head. The absence of the locomotive bristles and tentacles, found in the higher worms, such as Nereis, show its near relationship to the intestinal worms. But the metamorphosis is remarkable. The young is provided with two tentacles, which in the course of development drop off, thus affording us an instance of a retrograde course of development in the class of worms, like the Barnacle among Crustacea, the young of which have feet and antennæ, as in the little water fleas (Entomostraca), while in advanced life these limbs mostly drop off, and the animal would easily be mistaken for a shell fish.

We quote some directions for observing and collecting these young worms, so interesting as objects for the microscope:

Johannes Muller was the first who successfully employed surface dredging with a fine gauze net; he has been followed with eminent success by many of his pupils, and now scooping the surface of the sea in search of diminutive animals, scarcely to be recognised with the naked eye, is one of the most profitable sources of supply for recent investigators at the sea-shore. Baur has introduced fishing with the gauze net by sinking it to any desired depth, and this promises to be a fruitful mode of finding what cannot be reached with the hand net. Meyer and Mobius, in their investigations of the Fauna of the Bay of Kiel, have even attempted, with remarkable good fortune, to pump up from the vicinity of the bottom any animals there abounding.

Artificial fecundation can do much towards adding to our knowledge of the early stages

of marine animals, but any one who has lived at the sea-shore and endeavored to keep alive these tiny creatures, will soon find in this method insurmountable obstacles to pursuing his investigations beyond very narrow limits. The only way is to go to the fountain head at once, to make oneself familiar with the currents at all hours of the tide and under all possible influences of wind; to notice the place where opposite currents meet, and throw into long bands the wealth of animal life they have swept along; to become so perfectly familiar with what you may expect to find under certain conditions, that no time shall be lost in looking for the most favorable spot which otherwise you would only stumble upon accidentally. The habitat of the adult animals should be carefully observed, so that by surface dredging with the fine gauze hand-net in the vicinity of their abodes, and by a close attention to the direction which the currents take from these places, at the time of breeding, we can often obtain specimens at all ages and of all sizes, till they have ceased to be nomadic or have assumed the habits they retain in their adult condition.

NATURAL HISTORY MISCELLANY.

BOTANY.

THEORY OF THE ORIGIN OF THE ANTHER OF FLOWERS.—Dr. Müller read a memorandum of the monstrosities which he had met with in the flower and fruit of the *Jatropha pohliana*, and deduced therefrom some conclusions on the theory of the anther. He thinks that this is formed neither by the combination of two ordinary leaves, nor by a leaf whose edges are incurvated towards the median rib, so as to form the two chambers of the pollen. He believes that the anther represents only a single leaf, and that the pollen is developed in the incrassated tissue of the parenchyma of this leaf.—*Report of the Transactions of the Society of Physics and Natural History of Geneva*, 1863-5. *Smithsonian Report*, 1865.

PHYSIOLOGICAL EFFECTS OF THE CALABAR BEAN.—Dr. Dor read a memoir on the physiological effects of the bean of Calabar, *Physostigma venenosa*. Studied specially in its effects on the eye, this substance produces contraction of the pupil, and occasions a sort of cramp of the accomodator muscle. In this double relation it acts as an antagonist of the atropina.—*Ibid.*

SKELETON LEAVES.—The following method has been communicated to the Botanical Society of Edinburgh:—"A solution of caustic soda is made by dissolving 3 oz. of washing soda in 2 pints of boiling water, and adding 1½ oz. of quick lime, previously slacked; boil for ten minutes, decant the clear solution and bring it to the boil. During ebullition add the leaves; boil briskly for some time—say an hour, occasionally adding hot water to supply the place of that lost by evaporation. Take out a leaf and put into a vessel of water, rub it between the fingers under the water. If the epidermis and parenchyma sepa-

rate easily, the rest of the leaves may be removed from the solution, and treated in the same way; but if not, then the boiling must be continued for some time longer. To bleach the skeletons, mix about a drachm of chloride of lime with a pint of water, adding sufficient acetic acid to liberate the chlorine. Steep the leaves in this till they are whitened (about ten minutes), taking care not to let them stay in too long, otherwise they are apt to become brittle. Put them into clean water, and float them out on pieces of paper. Lastly, remove them from the paper before they are quite dry, and place them in a book or botanical press."—*Dr. G. Dickson, Hardwicke's Science Gossip, Jan.* 1. 1867.

ZOÖLOGY.

THE EDIBLE CRAB IN SALEM.—A large specimen of the common Edible Crab of the Southern markets, *Lupa dicantha*, was caught in the Millpond during the past winter. With the exception of a young specimen found on Phillips' Beach, it has not before been known to occur so far north as Massachusetts Bay. The Millpond is an inlet of Salem harbor, and the water is quite salt.—C. COOKE.

MIMETIC FORMS AMONG THE BUTTERFLIES. — Mr. A. R. Wallace states before the British Association, that "the *Heliconidæ*, a group of butterflies with a powerful odour, such as to cause birds to avoid eating them, were simulated by the females of another group, which had no smell, and might otherwise fall ready victims to birds. By their great resemblance to the obnoxious butterflies, the scentless females were enabled to escape pursuit, and deposit their eggs."—*The Reader, London, Oct.* 6, 1866.

FERTILE WORKERS AMONG THE HONEY BEES.—Mr. Tegetmeier, at the meeting of the Entomological Society of London, June 4, 1864, exhibited some drones hatched from eggs laid by fertile workers:

They were produced by placing in March, a comb containing eggs and larvæ *in workers' cells only*, in a hive which had been sometime without a queen, and which consequently contained no brood whatever. There was no apparent attempt made by the bees to form a royal cell and to rear a new queen from the workers' eggs, but after the latter were hatched the bees produced from them laid eggs. These were deposited in the drone cells only, sometimes as many as six being placed in one cell, of which only one was hatched, a drone in all cases being produced. It was noticed that these fertile workers were hatched and laid eggs before any drones had been observed in the adjacent hives. Huber supposed that such workers were produced by partaking of some of the food designed for the production of a queen, which had been deposited in the cells adjacent to the royal one. This supposition was disproved, as there was no royal cell in the single brood comb which the hive contained.

He shows that a too close interbreeding in bees is prevented by drones from other hives entering into the hive—while stranger work-

ers are killed, stranger drones are readily received; thus the deterioration of the race is prevented.

A BLACK VARIETY OF THE COMMON RED SQUIRREL, *Sciurus Hudsonicus* Pallas. I have lately obtained a black specimen of the common Red Squirrel. It was killed at Letang, New Brunswick, where neither the Grey, nor the common Black Squirrel are known to occur.—G. A. BOARDMAN.

GEOLOGY.

DISCOVERY OF A HUMAN JAW IN A BELGIAN BONE CAVE.—Dr. Dupont has discovered in the Bone Caves of Farfooz, near Dinant, in Belgium, a strange human jaw. It is the opinion of Sir. W. V. Guise, and Rev. W. S. Symonds, who have examined this locality,

"That the geological period of the entombment of the human jaw, with the remains of the extinct animals with which it was associated, may be assigned to the epoch known to geologists as the *low level drift period* of Prestwich, a period recent in a geological sense, but enormously remote when measured by *time*, for the cold of the glacial epoch was not altogether passed, and the extinct mammalia were still in existence. It was the period of the deposition of the old river drifts of Menchecourt, near Abbeville, which contain their human flint implements, interbedded with the bones of the Mammoth and Rhinoceros; the period of the deposition of the ancient river beds near Salisbury, and other parts of England, which teach the same history; and also, they believe of the English bone caverns."—*The Reader. London, Sept.* 1, 1866.

A LIZARD-LIKE SERPENT FROM THE CHALK FORMATION OF ENGLAND.—Fossils indicating a creature of this character have been discovered by Mr. H. E. Seeley.—*The Reader, London, Oct.* 6, 1866.

DISCOVERY OF GENUINE CHALK IN COLORADO AND DACOTA.—"Chalk has at last been found in this country—genuine chalk, with flints and an abundance of fossils. Smoky Hill, Colorado, is an outlying mass of chalk, probably the only remainder of a vast mass which denudation has removed."—*T. A. Conrad, Smithsonian Report*, 1865.

Dr. F. V. Hayden has also discovered in Yankton, Dacota Territory, large deposits of a "nearly white, soft chalk," which "will be found to represent the White Chalk Beds of Europe, and be employed for similar economical purposes."—*Amer. Journal Science and Arts, Jan.* 1867.

CORRESPONDENCE.

ON THE PLUMAGE OF THE BLACK GUILLEMOT.—How does it happen that we find the Black Guillemot (*Uria grylle* Lath.), in full black plumage all winter? All our works on Natural History tell us they change to white or grey in winter, but I often get specimens which are black in mid-winter. May it not be that only the young are light in winter? I can hardly think it possible some would remain black, and others change; I can see no difference between my dark winter and summer specimens.—G. A. BOARDMAN, *Milltown, Me.*

NATURAL HISTORY CALENDAR.

ORNITHOLOGICAL CALENDAR FOR MARCH.—In this Calendar we have endeavored to indicate the average time of the arrival and departure of the migratory birds in the State of Massachusetts for this month; in years when the cold of winter ceases earlier or later than the average opening of spring, as well as in districts north or south of this State. When the dates are found to be respectively too early or too late, the difference increasing in the latter, cease with the increase of the difference in latitude. Thus, some birds wintering in the Southern States, reach Washington, D. C., in their northward migration three weeks earlier than they do Massachusetts; in Southern Pennsylvania two weeks, and Southern New York nearly one week earlier; while the same species commonly reach the middle of Maine some ten to twelve days later than they do Massachusetts.

1st to 10th.—Blue Birds, Song Sparrows, Robins, Purple Grakles, Red-winged Black Birds, Rusty Grakles and Cow Birds, begin to arrive.

10th to 20th.—The preceding become more common. Meadow Larks, Bridge Pewees or Phœbes, Snow Birds and Purple Finches, begin to arrive; the Hawks that in winter are represented by but few individuals, as the Marsh, Red-tailed, Red-shouldered, etc., increase in numbers by arrivals from the South. The Goshawks, Snowy Owls and other Northern visitors of the raptorial tribes mostly retire northwards.

20th to 31st.—All those previously arrived receive new accessions to their numbers, and become generally distributed. Grass Finches, Mourning or Carolina Turtle Doves, Passenger Pigeons (of late, uncertain visitors), and the Fox-colored Sparrows arrive; the Black Duck (*Anas obscura*), Canada and Brant Geese, Goosanders or Sheldrakes, Whistle-wings or Golden-eyes, Wood and Pintail Ducks, Red-breasted and Hooded Mergansers, Divers, and several species of Grebes begin to frequent the rivers and open ponds, as well as the coast. Some of the sea-fowl that are winter visitors, as the Eider Duck, Double-crested Cormorant, Skuas or Jager Gulls, Black-backed and Laughing Gulls, and Guillemots, return northwards; other kinds, as the Red-headed, Canvas-back, Ruddy, Surf Ducks, Scoters, King, Eiders, Kittiwake and Bonaparte's Gulls, Arctic Tern, and other species of the Duck and Gull tribes begin to arrive from the South; Snow Buntings and such rare land birds as the Pine Grosbeak, White-winged Crossbill, the Arctic Three-toed Woodpecker (*Picoides arcticus*) and Lesser Redpoll, leave for the north, as do also many of the Butcher Birds.

Such early breeding species as some of the Hawks and Owls pair during this month; some, as the White-headed Eagle, Duck Hawk

and Great Horned Owl, which begin their courtships as early as February, choose their eyries, and the former commences incubation. Blue Birds frequently pair before the end of the month, and taking possession of breeding boxes or holes in trees, guard them carefully against intruders.—J. A. A.

The Robins often lay the eggs for their first brood in March, in the vicinity of Salem.—EDS.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

AMERICAN ACADEMY OF ARTS AND SCIENCES, *Boston. Jan.* 8, 1867. The following papers were read:

Thermogenesis, or Theory of Temperature, by Dr. J. D. Whelpey, of Boston.

The Object and Method of Mineralogy, by T. Sterry Hunt, of Montreal, Canada.

On the Inequalities produced in the Moon's Motion by the Secular Variation in the position of the Ecliptic, by G. W. Hill, of Cambridge.

ESSEX INSTITUTE, *Salem. Jan.* 7, 1867.—The following paper was presented:

A Catalogue of the Birds of North America contained in the Museum of the Essex Institute, with which is incorporated a List of the Birds of New England, with brief critical notes, by Elliott Coues, M. D., U. S. A.

Mr. C. Cooke made some remarks on the Sea Coco (*Lodoicea sechellarum*); and Mr. E. Bicknell exhibited sections, mounted for the microscope, of the poison fangs of the Rattlesnake.

ACADEMY OF SCIENCES, *Chicago. Annual Meeting, Jan.* 8, 1867.—Dr. William Stimpson was appointed Director of the Museum, to fill the vacancy caused by the death of Major R. Kennicott.

The President, Geo. C. Walker, Esq., delivered his annual address.

The Secretary then submitted his annual report.

The following resolutions were passed:

WHEREAS, The appropriation for the Illinois ~~General~~ Survey has been too small to allow of a sufficiently rapid examination: Geological

Resolved, That this Academy desires to express its sense of the great importance of this work, and its hope that the appropriation will be increased to a degree that will carry on the State Survey with a greater rapidity than heretofore.

Resolved, That our Representatives in the General Assembly be respectfully requested to favor the increase of the appropriation.

BOSTON SOCIETY OF NATURAL HISTORY. *January* 2, 1867.—Mr. Horace Mann exhibited a large panoramic photograph of the crater on the summit of Haleakala, the mountain of East Maui, Hawaiian Is-

lands. This crater is situated on the summit of Haleakala, its rim being at the average elevation of 10,000 feet above the sea. Its depth is about 2,000 feet, and the comparatively level plain which forms its floor, therefore, at an elevation of 8,000 feet. The whole circumference of the crater is thirty or thirty-five miles, it being one of the largest in the world.

Mr. Winwood Reade, of England, who was present as a visitor, read to the Society a paper upon the habits of the Gorilla, the result of his personal investigation in the Gaboon region.

Section of Entomology, Jan. 23.—Mr. Scudder remarked on a small collection of fossil insects obtained by Prof. William Denton, in the Tertiary, probably Miocene, beds of Green River, near the boundary line of Colorado and Utah Territories. The number of species amounts to about fifty, though they are so imperfectly preserved as to be difficult, if not impossible, to identify.

The most abundant forms are Diptera, and they comprise indeed two-thirds of the whole number, either in the larval or imago state; the others are mostly very minute Coleoptera, and there are besides several Homoptera, minute parasitic Hymenoptera, *Pteromali*, a *Myrmica*, a moth, and a larva, apparently allied to that of *Limacodes*.

The perfect Diptera are mostly small species of Mycetophilidæ and Tipulidæ. There are besides some which are apparently Muscidæ. Among the larvæ are those of Muscidæ, together with other larvæ belonging to species of which the adults are not represented on these stones. The Homoptera belong to genera allied to Issus, Gypona, Delphax and some of the Tettigonidæ. The collection does not agree, in the aggregation of species, with any of the insect beds of Europe, or with the insects of the amber fauna on the shores of the Baltic.

A paper was also read *On Monstrosities observed in the wings of Lepidopterous Insects, and on the method of producing them artificially*, by L. Trouvelot.

Illinois Natural History Society. *Bloomington, Annual Meeting, December* 19, 1866. The following resolution was passed:

Resolved, That the corresponding secretary and the general commissioner be instructed to correspond and confer with the principals and professors of natural science of the various schools and colleges in the state, with naturalists and friends of natural science, with a view to the organization of local auxiliary societies, to the securing of local collections and the organization of a general system of exchanges, under the supervision of the Board of Directors.

Papers were presented to the society both at the June and the present meeting, by Prof. Marcy, of the Northwestern University, Dr. Vasey, Prof. Sewall, of the State Normal University, and Dr. F. Brendel, of Peoria.—*Prairie Farmer.*

Note.—The Editors desire *brief minutes*, such as those given above, of *every* meeting of all the Scientific Societies in North America. A copy of the Naturalist will be sent to each Secretary, personally, free of expense, so long as such reports are promptly sent in to this office.